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Research Article

Food Alteration Phenomena: Biological and Physico–Chemical Alteration

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Abstract

All foods degrade over time longer or shorter than the date of manufacture or preparation, losing its initial characteristics, thus becoming, unfit for consumption and even dangerous for human health and life. Depending on the degradation time, foods are classified into: perishable foods that degrade in a few days, such as: fresh milk, meat, mayonnaise, lettuce, fresh cow cheese, etc.; and non–persistent foods that degrade over a longer period of time, such as: pasta, dried vegetables, sterilized foods, food fats, etc. The degradation of food can have different consequences on their qualitative and nutritional qualities, as well as on the health of consumers, distinguishing the following situations: food aging, a process whereby foods can lose some of their nutritional value and sensory characteristics that they have fresh; altering food, a process by which food gets abnormal appearance and smell, which makes them no longer edible, and also becomes dangerous to human health; food contamination, a process caused by external agents such as bacteria, molds, causing food to become dangerous to human health, causing food poisoning that can culminate in the death of the individual. To this is added a series of parasites, pesticides, technological toxins, environmental pollutants, etc. Unlike other products, foods are more important to consumers. Besides providing daily nutrition needs, if they are contaminated or altered, they directly affect our health and can even endanger our lives. Organizational and technical measures are required to prevent harmful actions and undesirable changes in food products. The preservation of prescribed quality must be ensured for food products, from producer to consume such as by packaging, handling, transport, storage, exposure for sale.

INTRODUCTION

The food alteration phenomena and contamination relevant to the developing and developed world.Consumers must be more demanding with altered or expired products. Foods must be safe. They should not endanger our health or affect it; we must not receive expired, contaminated or altered food. The most important health risks associated with food are: microbiological contamination of food; chemical contamination with pesticides, heavy metals or other toxic substances; the use of prohibited food additives or in quantities higher than those permitted; or the presence of antibiotics in food. We must store cold perishable food, consume it within its shelf–life, maintain hygiene rules when preparing food, roasting, boiling, or frying meat well before eating it [1]. The food chain consists of 4 links: producers of raw materials (agricultural producers); producers of finished products (manufacturers, processors); distributors (traders); and consumers [2].

THE PHENOMENON OF ALTERATION

Food degradation is called alteration; is caused by one or more factors. It can be:

Biological alteration

Caused by microorganisms and enzymes. Microorganisms are microscopic beings that have a propagating energy and high velocity, exchange substances between the outside and the cell of the microorganism [3]. Yeast, by fermentation, converts sugar into carbon dioxide and alcohol–Acetyl bacteria develop acetyl bacteria that convert alcohol into acetic acid to this environment rich in ethyl alcohol. Acetic acid can be consumed by molds resulting in carbon dioxide and water [4]. The alteration of animal food is caused by the putrefactive bacteria that decompose albinoid substances into assimilable products. Alteration is signalled by volatile substances (ammonia, hydrogen sulphide) [5]. The surface of the meat becomes damp, sticky, the fibers soften, and the color closes, and then takes a gray or green look [6]. Enzymes are organic substances that act as biochemical catalysts. Their action is conditioned by the environment and the temperature of 70°C. They are relieved by oxidases, catalases, peroxidases. They cause colour, taste, and even smell of food [7]. Microorganisms are widespread in nature where they play an essential biological role in the development of many phenomena [8]. So, microorganisms are the ones that make the improvement of soil fertility as well as in soil transformation, as well as the transformation of organic

vegetal or animal materials through putrefaction processes [9]. Numerous species of microorganisms are used in various industrial processes such as wine and beer, antibiotics, and food products. But the existence of microorganisms in nature is often undesirable [10]. Some, although they cannot grow in food, can survive for a while and are only transmitted in this way; others finding favourable development conditions, even in the case of an initially low number, multiply and cause degradation of the product they have proliferated. For this reason, the phenomenon of food alteration is the main cause of damage caused by the development of microorganisms. Foods can also be contaminated with pathogenic germs and in this situation; they become the transmitting or causative agents of diseases [11–13].

Physico–chemical altering

Caused by factors such as light; the air; and heat. These factors cause colour change that is the first stage in general food alteration or odour–the appearance of a foreign odour. You can also change your taste (example: roasting). Depending on the intensity of action, physicochemical agents (temperature, oxygen tension, humidity, osmotic pressure, hydrogen ion concentration (pH), etc.) may have favourable or harmful effects on the metabolism of the bacteria. The minimum, between which development is possible, the action of a physicochemical agent is harmful [14-16]. Between these limits there is an optimal area where the beneficial effects are maximal, ensuring the development and normal life of the bacterial cells. Harmful action has the effect of stopping the development of bacteria, which can be reversible (inhibited) or irreversible (killing), as the indispensable cellular components have undergone or are not incompatible with life [17-19].

In the food industry, both the favourable and harmful effects of physicochemical agents are used in the food industry as microorganisms are used for the purpose of technology or are harmful and their development must be stopped [7,20]. Foods at the time of consumption, both those obtained directly from the nature by harvesting and those which have undergone an industrial or culinary processing process, must contain as little as possible micro–organisms in order to preserve their qualities for as long as possible organoleptic and nutritional and to avoid the risk of illness for the consumer [21-23].

The feed, vegetal and animal raw materials possess an initial degree of microbial contamination from natural sources (plants, animals, wastewater, soil, water, air), which, until the consumer, whether or not through other processing, suffers. Various variations of amplification or shrinking, depending on the favourable or unfavourable character for microbial development and survival of the operations, contacts and manipulators to which they are subjected [11,24]. A variety of parasites can spread through food, which can be for example in meat such as trichinella and chicory or dibotriocephal in fish meat and eggs. Infection with parasites can also occur with unspoiled vegetables and fruits [5,7], manipulated by pests, in various forms.

DISCUSSIONS

Foods may be contaminated with pathogenic microorganisms or toxic substances from different sources, with which they come into contact during production, transport, storage or preparation. The most important causes that cause food degradation are: physical factors: light, heat; chemical factors: the presence of oxygen and water; biological factors: microorganisms and enzymes [25-27].

The most important changes in food quality are determined by biological factors.

Microorganisms in food under various circumstances (production, conservation, processing, etc.) consume some of the continuous nutrients of food for their growth and reproduction. Thus, on the one hand, the nutritional value of these foods decreases; and on the other hand, the metabolism of contaminated microorganisms results in a series of toxins (endotoxins and exotoxins), making foods unsuitable for consumption, and if they are consumed, they cause food poisoning [29-31].

Food toxicities can be: Infectious – when caused by microorganisms that multiply in the body. The most common infections are: salmonellosis; the transmission of the pathogen being carried out in 70% of cases via egg. After 8-24 hours, symptoms appear in the form of fever, vomiting, diarrhoea. Toxic–when they are caused by the toxins present in food, which can even come from contaminated microorganisms (*Clostridium* sp., *Streptococcus* sp., *Proteus vulgaris*, etc.) [32-34]. Some enzymes present in food, under certain storage conditions, cause their degradation. For example, fruit and fruit juices contain some enzymes that in the presence of light and oxygen cause darkness and abnormal odour formation [35,36]. In order to prevent the phenomenon of food alteration caused by biological factors (microorganisms and enzymes), it is necessary to act on the factors that favour their activity, namely: temperature, pH, water presence, presence of oxygen [37-39]. Contamination of chemical foods (pesticides, disinfectants, mineral oils, etc.), biological (pathogenic bacteria, viruses, protozoa, enzymes etc.) and physics (foreign bodies, water) it can be:

- Primary contamination–when the raw material is contaminated from the beginning, from production, during transport or during food processing;
- Secondary contamination–when the raw material is “salubra” at the reception for processing; but during processing (semi-finished) it is contaminated (at preservation, boiling, temporary storage etc.)
- Tertiary contamination–when the semi–finished products are “salami”, but the finished product is contaminated during handling, conditioning, packaging, transport [40,41].

Processes that lead to food alteration are: fermentation, hydrolysis, oxidation, antholysis (ignition), putrefaction, toxin generation and are generated by biological factors (bacteria, yeasts, molds and enzymes). Carrying out the alteration processes requires: a certain temperature range; a certain degree of humidity (presence of water); lack of enzyme inhibitors; presence of oxygen (for aerobic processes). Food preservation methods are based on the elimination of one or more of the listed conditions, as well as on the subject of food, physical or chemical interventions that prevent alteration processes [17,42].

The alternation process starts in most cases on the surface and is caused by aerobic bacteria, beginning with the solubilization of proteins (by hydrolysis and oxidation processes). At the same time, by consuming oxygen from the superficial layers, optimum conditions are created for the installation of anaerobic bacteria that will induce the processes of rotting [43].

The biochemical process of protein decomposition takes place in the following stages: hydrolysis of proteins to peptides and amino acids; cleavage of amino acids through decarboxylation processes, which leads to formation of toxic substances for the organism (histamine, cadaverine, putrescine etc.) or by deamination, leading to the formation of ammonia, urea etc [44].

All of these are bad smells due to: oxidation of cleavage products, especially of aromatic amino acids [45], with the formation of substances (phenol, indole, *skatole*) with specific odor; decomposition of amino acids with sulfur (methionine, cystine, cysteine) with the formation of hydrogen sulphide (bad smell) and a series of very toxic substances for the body (mercaptans).

Hydrolytic decomposition of fat leads to the formation of free radicals and a series of toxic aldehydes for the human body [27,40]. Lipid hydrolysis is determined by specific enzymes (lipases) that can be active even at low temperatures (up to–29°C). The result is that the process of fattening slowly takes place in the freezer, even in the absence of air [46,47].

Generally, the enzymes have an optimal activity at 35–37°C, and as the temperature decreases, the enzymatic processes slow down, and below any temperature value virtually any enzyme activity ceases [48-50]. At temperature rise, the rate of reactions increases to a value at which the enzyme's protein component is thermally distorted and becomes inactive. Depending on the nature of the enzyme, the inactivation temperature varies between 45–100°C. More resistant are catalases and peroxidises [51,52]. Some enzymes, after deactivation, if they reach the optimal specific temperature, resume their activity (e.g. alkaline phosphatases, lipases).

CONCLUSIONS AND RECOMMENDATIONS

Keeping is the action of maintaining the quality of a product obtained with or without processing in a certain balance of interrelation with environmental agents. This action involves organizational and technical measures to prevent harmful actions and undesirable changes in the qualitative parameters of food products. At the same time, for some of the foodstuffs, the necessary environment is created for the favourable evolution of natural processes that contribute to the improvement of their qualitative qualities or to the acquisition of new ones (e.g., maturing of bread, cheese, wine etc.).

The preservation of prescribed quality must be ensured throughout food products, from producer to consumer, by special measures in terms of packaging, handling, transport, storage, exposure for sale etc. The date of minimum durability is the time limit set by the manufacturer, in which the food maintains its specific characteristics under the appropriate storage conditions.

The date of minimum durability consists of a clear indication of the day, month and year, in a non–coded chronological form. The date will be preceded by the statement: "Consume preferably before ...", if the day, month and year are indicated; or "Consume preferably until the end.", if the month and the year or only the year are indicated. Mentions are completed, as appropriate, with indication of storage and conservation conditions. The legislation provides for the inclusion of the minimum durability/date of durability, as the case may be, on products, individual packaging or in the accompanying documentation.

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